

Washington State Department of Health (DOH)
Copper in Drinking Water
Position Paper



Purpose

National drinking water regulations in 1991 first addressed copper as a contaminant with a potential for producing illness. Copper monitoring under federal and state rules focused upon water distribution system and household plumbing as sources of this contaminant resulting from contact with corrosive drinking water. Regulation for copper was intended to determine if a utility's drinking water was sufficiently corrosive to cause significant levels to be found at high-risk tap locations (single family residences with copper plumbing installed between 1982 and 1987) throughout a distribution system, and if so, to mandate corrosion control through source water treatment. A heightened awareness of copper-related concerns associated with new drinking water regulations led to voluntary samplings from some schools and office complexes out of interest, or in response to complaints from a portion of the occupants. On occasion, this voluntary monitoring suggested that copper concentrations, based upon levels being advanced by the Environmental Protection Agency (EPA) as having some health consequence, were of a magnitude that warranted closer consideration of potential health impacts for consumers.

This position paper is intended to provide Washington State health officials with some understanding of the issues surrounding copper in drinking water, and to present some recommendations which local jurisdictions may find helpful to address copper-related questions or problems which may occur in settings not currently included within a specific regulatory framework.

Background

Copper, long recognized as an essential metabolic nutrient, received initial regulatory attention in the 1974 federal Safe Drinking Water Act (SDWA) as a contaminant that could cause household fixture staining or taste problems (i.e., aesthetic impacts) in drinking water. Regulations subsequently developed in response to the 1986 Amendments to the SDWA recognized the health-related aspects of copper which had been under review and were just beginning to be better understood. Copper, determined by the EPA to be of health significance, was addressed as a contaminant of concern in drinking water systems through establishment of a regulatory "Action Level." Copper levels exceeding a prescribed Action Level of 1.3 milligrams per liter (1.3 mg/L) in more than 10 percent of all samples collected at household taps (kitchen or bathroom) served by the system's distribution works were considered to pose an unacceptable health risk to the receiving population. Exceedance of the Action Level signals the need for source water quality treatment to reduce the corrosiveness of the water, and hence the copper levels.

Source of the Contaminant

Copper in drinking water primarily results from dissolution of copper piping, which is commonly used for household plumbing. Waters with a low pH level and low mineral content generally are considered to be aggressive or corrosive, and capable of leaching

copper from pipes. Copper may also be leached from pipes in contact with non-aggressive water when such pipes are used to ground a household electrical system (an historically accepted, but now illegal, practice). Exposure to copper can occur from drinking copper-contaminated water or beverages made with such water. Consuming fluids that have leached copper from copper vessels or foods washed in water with elevated copper levels can also cause exposure.

Known Health Effects

Clinical Aspects

Persons with Wilson's disease (a genetic disorder characterized by an inability to regulate dietary intakes of copper from food or water), those with an underdeveloped or damaged ability to maintain normal copper homeostasis, or those with liver deficiencies are at greater risk to impacts from copper ingestion than most of the population. Copper can pose chronic toxicity problems for these susceptible individuals leading to debilitation or even death. However, very few people in the nation and the state of Washington are at such risk and their health concerns are best addressed by physicians on a case-by-case basis.

Acute-onset gastrointestinal irritation and inflammation are common indicators of copper toxicity at sufficient levels of exposure. However, there is a wide range of susceptibility to copper-induced health impacts within the population. Symptoms associated with copper toxicity may include nausea, abdominal cramping, diarrhea, vomiting, and headaches.

There is some evidence that infants and children up to ten years of age may be more susceptible to copper toxicity. There appears to be a need to be most cautious with respect to infants less than two years old.

General Public Health Aspects

Federal and state regulations are oriented to public water systems and allow for a marginal amount of high copper within the service area of the water utility. The locations specified (under regulatory direction) for sampling within water systems are restrictive in that large buildings, schools, institutional structures, etc., where copper could be problematic and the exposed population clearly definable, are excluded from the water system's sampling regime. It is therefore very difficult, if not impossible, at this time to determine what the general risks may be to a population receiving a corrosive water. Studies of populations exposed to elevated copper in drinking water have been lacking, and where some research has been performed, there are inconsistent conclusions. Nonetheless, it is well recognized that copper constitutes a major aspect of indoor plumbing throughout the nation and the opportunity for significant levels of exposure exists.

It appears that special attention may be warranted for newly constructed buildings with large amounts of copper plumbing, and for elementary schools. However, there is essentially no epidemiological evidence which associates elevated copper levels with outbreaks of gastrointestinal health problems in office or school settings, or in any other scenario for which population risks may be better estimated.

Diagnosis and Treatment

Since the symptoms associated with copper ingestion (for those who may be susceptible) are similar to those from many other potential causes, definitive diagnosis of copper toxicity is difficult. Often, the diagnosis must rely on ruling out other possible causes (both bacteriological and otherwise) and testing for elevated levels of copper in drinking water. Even then, given the highly variable susceptibilities of individuals to copper toxicity, the diagnosis may be missed, or made in error. Diagnosis is easier and more reliable in the situation where several cases showing similar symptoms can be connected to a common, potential causative agent (i.e., elevated levels of copper in drinking water or food, etc.).

Treatment of gastrointestinal distress associated with copper ingestion basically involves use of palliative drugs and therapies intended to diminish the symptoms (antacids, stomach coatings, etc.) and ensuring restricted ingestion of copper from food or water. For the majority of cases, the body's homeostatic mechanisms ensure recovery once the source of copper is discontinued.

Legal Standards or Requirements

For drinking water from federal- regulated Public Water Systems (Group A Systems in Washington State), federal and state regulations require monitoring for copper to determine if corrosion control treatment is needed. Treatment is required for corrosion control whenever the Action Level (i.e., 1.3 mg/L copper for the ninetieth percentile sample from all the samples collected from a utility's distribution system) is exceeded based on sampling at household tap locations throughout the system. There are no standards or requirements for copper monitoring or treatment for any other class of public water system or individual residences.

Recommended Preventive Measures and Response Actions

General Recommendations

- Special emphasis should be placed on awareness of unusual clusters of gastrointestinal illnesses in school or daycare settings which, although most likely associated with microbiological causes, may be associated with ingestion of copper, other heavy metals, or other environmental contaminants.
- Public information materials regarding the health implications, sources of, and means for reducing individual and collective risks to copper exposure should be distributed to all local health jurisdictions for distribution to health care providers and the general public when determined appropriate.

These recommendations reflect the general lack of information regarding health risks associated with exposure to elevated levels of copper in drinking water. They further emphasize the need for increased attention to the possible relationship that may be prevalent in some specific environments where unusual numbers of gastrointestinal illness occur that may be associative with copper ingestion.

Recommendations Related to with Children

- If unusual incidences of gastrointestinal illness are noticed in elementary schools, day care facilities, or health care facilities which routinely serve children, the facilities (plumbing system), although not under any regulatory requirement to do so, should be considered for copper testing using EPA protocols (Lead and Copper Rule).
- Given the paucity of information for copper levels in certain facilities which are not currently under regulatory purview, coupled with a marginal understanding of the public health risks for children, it is considered valuable to establish baseline information regarding the extent of exposure to copper. Consideration for such testing would be especially appropriate for facilities with substantial amounts of newly installed copper plumbing. Running tap water samples (i.e., taken after a tap has been operated for more than a minute) should be collected from water stations which would be used routinely by the occupant children.
- In conducting this sampling, if copper levels are observed to be in excess of 1.3 mg/L, then special efforts to monitor the situation, such as enhanced surveillance for possibly related clusters of gastrointestinal illness should be undertaken.
- If, based upon these enhanced surveillance efforts, an unusual number of illnesses appear to be occurring, while recognizing that other causative agents may be more suspect, detailed investigations can be undertaken to evaluate the possibility of copper toxicity. The DOH Office of Epidemiology and Environmental Health Programs can assist with these.
- If sample locations show copper levels lower than 0.3 mg/L, they can reasonably be considered to be low risk sources for copper toxicity concerns.

Recommendations Associated with Adults

For adults, if water tests from taps in new or refurbished buildings show running water levels for copper in excess of 1.3 mg/L, then special efforts to monitor the situation, such as enhanced surveillance for possibly related clusters of gastrointestinal illness should be undertaken. If the surveillance indicates that an unusual number of illnesses are being reported, then more detailed investigations should be undertaken to evaluate the possibility of copper toxicity. The DOH Division of Drinking Water may be consulted for advice and direction as to the potential remedial actions that may apply on a case-by-case basis.

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